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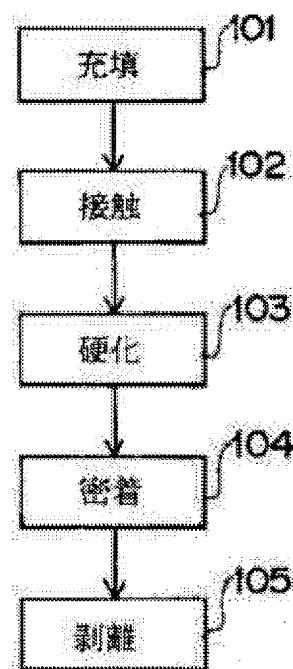
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(54) PRODUCTION OF LIGHT DIFFUSION SHEET

(57)Abstract:

PROBLEM TO BE SOLVED: To enable a simple production easy in the control of the optical properties.

SOLUTION: The producing method is provided with a coating process for applying the prescribed quantity of an ionizing radiation curing resin on a transparent resin sheet with a coating device, a filling and contact processes 101, 102 for filling the ionizing radiation curing resin liquid at least in recessed parts of a roll intaglio by rotating the roll intaglio, on which a die with fine embosses having light diffusing properties is formed, bringing the roll intaglio into contact with the transparent resin sheet base material travelling synchronously in the rotating direction of the roll intaglio and pressing the transparent resin sheet base material into the roll intaglio with a press roll, a curing process 103 for curing the ionizing radiation curing resin liquid existing between the roll intaglio and the sheet base material by irradiating it with ionizing radiation during the sheet base material is in contact with the roll intaglio, a close contact process 104 for bringing the ionizing radiation curing resin liquid and the sheet base material into close contact with each other and a stripping process 105 for stripping the hardened material of the ionizing radiation curing resin liquid and the sheet base material from the roll intaglio.



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CLAIMS

[Claim(s)]

[Claim 1]A roll intaglio in which a mold of a coating process which coats ionizing-radiation-hardening-resin liquid of the specified quantity with a coating apparatus to a transparent resin sheet base material, and existing detailed embossed geometry of; light diffusibility was formed is rotated, By contacting said transparent resin sheet base material which carries out a strike synchronizing with a hand of cut of the roll intaglio, and pressing said transparent resin sheet base material to said roll intaglio with a pressing roll simultaneously, Restoration and a contact process of said roll intaglio which fills up a crevice with ionizing-radiation-hardening-resin liquid at least; while said sheet base material touches said roll intaglio by said restoration and contact process, Ionizing-radiation-hardening-resin liquid between said roll intaglio and said sheet base material is irradiated with ionizing radiation. An adhesion process at which said ionizing-radiation-hardening-resin liquid hardened by curing process to stiffen and the; aforementioned curing process and said sheet base material are stuck; a peeling process and; which exfoliate a hardened material and said sheet base material of said ionizing-radiation-hardening-resin liquid which is said adhesion process and was stuck from said roll intaglio. A manufacturing method of an included optical diffusion sheet.

[Claim 2]A manufacturing method of an optical diffusion sheet viscosity of said ionizing-radiation-hardening-resin liquid being 5000 cps or less in a manufacturing method of the optical diffusion sheet according to claim 1.

[Claim 3]A manufacturing method of an optical diffusion sheet skin temperature of said roll intaglio being about 15 ** – 50 ** in a manufacturing method of the optical diffusion sheet according to claim 2.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the manufacturing method of the optical diffusion sheet used for the source of back light of a liquid crystal display, etc.

[0002]

[Description of the Prior Art] Conventionally, this kind of optical diffusion sheet coating and manufacturing the lusterless clear coating which made transparent sheets, such as ** polyethylene terephthalate (PET) sheet, distribute particles, such as calcium carbonate and diacid-ized silicon, or using ** cloudy weather glass plate is known.

[0003]

[Problem to be solved by the invention] However, in the method of the aforementioned **, in order to distribute in a coat the substance in which refractive indices differ like a binder and particles, for a certain reason, the optical absorption of the particle itself also has low light transmittance, and the luminosity of a liquid-crystal-display side is not fully obtained. For this reason, although raising the luminous intensity of a light source is also considered, since power consumption and calorific value increase, it is not desirable. It is easy to generate the luster unevenness by the convection of the maldistribution of a paint, and the paint at the time of a coating and desiccation, etc. It is easy to generate change of gloss by change of coating conditions.

[0004] In the case of a cloudy glass plate like the aforementioned **, a glass plate is heavy, and it is easy to be divided and also hard to carry out processings, such as cutting. In order to also depend lusterless processing on sand blast attachment etc., it takes time and effort.

[0005] Even if it is any of the aforementioned ** and **, the detailed embossed geometry acquired is only monotonous form determined by the processing method, and cannot control optical properties, such as transmissivity of light, and a diffusion angle of the transmitted light, to a desired value.

[0006] The purpose of this invention is to provide the manufacturing method of the optical diffusion sheet in which solve above-mentioned SUBJECT, manufacture is easy, and control of an optical property is easy.

[0007]

[Means for solving problem] In order to solve said SUBJECT, often to this invention the manufacturing method of an optical diffusion sheet, The roll intaglio in which the mold of the coating process which coats the ionizing-radiation-hardening-resin liquid of the specified quantity with a coating apparatus to a transparent resin sheet base material, and the existing detailed embossed geometry of; light diffusibility was formed is rotated, By contacting said transparent resin sheet base material which carries out a strike synchronizing with the hand of cut of the roll intaglio, and pressing said transparent resin sheet base material to said roll intaglio with a pressing roll simultaneously, The restoration and the contact process of said roll intaglio which fills up a crevice with ionizing-radiation-hardening-resin liquid at least; while said sheet base material touches said roll intaglio by said restoration and contact process, The ionizing-radiation-hardening-resin liquid between said roll intaglio and said sheet base material is irradiated with ionizing radiation. The adhesion process at which said ionizing-radiation-hardening-resin liquid hardened by the curing process to stiffen and the; aforementioned curing process and said sheet base material are stuck; it has a peeling process which exfoliates the hardened material and said sheet base material of said ionizing-radiation-hardening-resin liquid which is said adhesion process and was stuck from said roll intaglio, and composition containing;. In this case, it can be characterized by the viscosity of said ionizing-radiation-hardening-resin liquid being 5000 cps or less. It can be characterized by the skin temperature of said roll intaglio being about 15 ** - 50 **.

[0008] According to this invention, since resin is fabricated with a roll intaglio which coats resin liquid

and has a crevice on a sheet base material, detailed embossed geometry of desired form is faithfully reproducible. Light diffusibility detailed embossed geometry is formed in the surface of transparent resin, and an inside is not made to distribute foreign matter particles. Carrying out the strike of band-like Webb's sheet base material, detailed embossing can be formed by a rotary shaping system using a roll intaglio, and the shaping can also be stiffened instantly by ionizing radiation.

[0009]

[Mode for carrying out the invention] Hereafter, with reference to Drawings etc., an embodiment is described in more detail. Process drawing and drawing 2 in which an embodiment of a manufacturing method of an optical diffusion sheet according to drawing 1 to this invention was shown are a figure showing an embodiment of a manufacturing installation of an optical diffusion sheet by this invention. Here, a manufacturing method and a manufacturing installation of an optical diffusion sheet by this embodiment are explained briefly first. In drawing 2 (A), a roll intaglio in which desired unevenness was formed 1, and 2 A crevice of the roll intaglio 1, A hardening device for a pressing roll which 3 contacts ionizing-radiation-hardening-resin liquid, 4 contacts a sheet base material, and 5 contacts a roll intaglio, and presses the roll intaglio 1, and 6 to send, and for a roll and 7 harden the ionizing-radiation-hardening-resin liquid 3, and 10 are the coating apparatus for coating the ionizing-radiation-hardening-resin liquid 3 to the roll intaglio 1.

[0010] As the manufacturing method of the optical diffusion sheet of this embodiment is shown in drawing 1, the packer comprises 101, the contact process 102, the curing process 103, the adhesion process 104, and the peeling process 105. Like a packer, 101 rotates the roll intaglio 1 in which the mold of the existing light diffusibility detailed embossed geometry was formed, and is the process of the roll intaglio 1 of filling up the crevice 2 with the ionizing-radiation-hardening-resin liquid 3 at least. The contact process 102 is a process at which the transparent resin sheet base material 4 which carries out a strike synchronizing with the hand of cut of the roll intaglio 1 to the ionizing-radiation-hardening-resin liquid 3 filled up with 101 into the roll intaglio 1 like a packer is contacted. The curing process 103 is a process which makes the ionizing-radiation-hardening-resin liquid 3 between the roll intaglio 1 and the sheet base material 4 irradiate with and harden the ionizing radiation from the hardening device 11, while the sheet base material 4 touches the roll intaglio 1 by the contact process 102. The adhesion process 104 is a process at which the ionizing-radiation-hardening-resin liquid 3 hardened by the curing process 103 and the sheet base material 4 are stuck. The curing process 103 and the adhesion process 104 usually advance simultaneously. The peeling process 105 is a process of exfoliating the hardened material 3a and the sheet base material 4 of the ionizing-radiation-hardening-resin liquid 3 stuck at the adhesion process 104 from the roll intaglio 1.

[0011] Next, it explains to the manufacturing installation of the optical diffusion sheet by this embodiment in detail, mainly referring to drawing 2 (A). The roll intaglio 1 forms the crevice 2 of the prescribed shape later mentioned to a cylindrical plate. This roll intaglio 1 can be manufactured with a method, electroforming, etc. which carry out engine lathe processing directly, or are cut to a cylindrical plate by mill processing by the mill formed with electroforming, etc. As construction material of the roll intaglio 1, Ceramics Sub-Division, such as synthetic resins, such as metal, such as copper, chromium, and iron, NBR, epoxy, and ebonite, and glass, etc. can be used. The size in particular of the roll intaglio 1 is not limited, but can be suitably chosen according to the size of the sheet which has an irregular surface which is going to manufacture. Although not illustrated, the roll intaglio 1 is formed so that a drive may be formed and may rotate.

[0012] As mentioned above, the viscosity of the resin liquid 3 like the roll intaglios 1A-1D shown in drawing 12 as a method of adjusting to a predetermined value, Make an inside hollow, and flow, fluids which carried out the temperature control, such as water, an oil, and a steam, are made to flow into a moderate temperature at the centrum, and the method of controlling the version skin temperature of the roll intaglios 1A-1D to a specified value can be applied. generally, viscosity falls, so that it becomes an elevated temperature -- quantity -- since decomposition evaporation of the resin liquid 3, etc. will take place if too tepid, although it changes also with resin, about 15 ** - 50 ** are preferred.

[0013] In order to flow and to make said fluid flow out here, like drawing 12 (A), Like the system which pours a fluid to the other side from the one side of the axis of rotation 1a of the roll intaglio 1A, and drawing 12 (B), Like the system which returns the fluid which inserted the feed pipe 1b in the inside of the roll intaglio 1B, and was sent in the inner part of the roll intaglio 1B with the feed pipe 1b in accordance with the wall of the roll intaglio 1B, and drawing 12 (C), It is [the system which forms the roll intaglio 1C and the inner tube 1c of approximately similar figures inside the roll intaglio 1C, and lets a fluid pass between the roll intaglio 1C and the inner tube 1c inside, and] the puncturing 1e to the inside of the roll intaglio 1D like drawing 12 (D). The feed pipe 1d with which many [referring to

drawing 12 (E)] were provided is inserted, and the system etc. which return the fluid injected from the puncturing 1e of the feed pipe 1d in accordance with the wall of the roll intaglio 1D are held. In this case, in order to carry out the temperature control of the version surface uniformly, the form of the roll intaglio 1D is preferred.

[0014]As the ionizing-radiation-hardening-resin liquid 3, the constituent which mixed suitably the prepolymer, oligomer, and/or the monomer which have a polymerization nature unsaturated bond or an epoxy group can be used into a molecule. As said prepolymer and oligomer, unsaturated polyester, such as a condensate of unsaturated dicarboxylic acid and multiple-value alcohol. An epoxy resin, polyester methacrylate, polyether methacrylate, Acrylate, such as methacrylate, such as polyol methacrylate and melamine methacrylate, polyester acrylates, epoxy acrylate, urethane acrylate, polyether acrylate, polyol acrylate, and melamine acrylate, is raised.

[0015]As said monomer, styrene monomers, such as styrene and alpha-methylstyrene, Methyl acrylate, acrylic acid-2-ethylhexyl, acrylic acid methoxy ethyl, Acrylic ester, such as butyl acrylate, methyl methacrylate, Methacrylic acid ester, such as ethyl methacrylate, methacrylic acid methoxy ethyl, and methacrylic acid ethoxymethyl. The substitution amino alcohol ester species of unsaturated acid, such as acrylic acid-2-(N and N-diethylamino) ethyl, Unsaturation carboxylic amide, such as acrylamide and methacrylamide, dipropylene glycol diacrylate, Ethylene glycol acrylate, propylene glycol dimethacrylate, Polyfunctional compounds, such as diethylene-glycol dimethacrylate, vinyl pyrrolidone, And/or, the polythiol compound which has two or more thiol groups, for example, trimethylolpropane bird thioglycolate, a trimethylolpropane bird CHIOPUROPI rate, a pentaerythritol tetra thioglycol, etc. are raised into a molecule.

[0016]In making it harden by ultraviolet rays especially, to the constituent of said ionizing radiation hardening resin as a photopolymerization initiator, Acetophenones, benzophenones, MIHIRA benzoyl benzoate, N-butylamine, triethylamine, tri-n-butyl phosphine, etc. can also be mixed and used as alpha-amylomaize Qeshm ester, tetramethyl MEURAMU monosulfide, thioxan tons, and/or a photosensitizer. As for especially viscosity, in order to meet in the form of the roll intaglio 1 which had the fine crevice 2 like this embodiment faithfully, it is preferred to use 1000 cps or less 5000 cps or less.

[0017]The resin sheet in which the sheet base material 4 has the permeability of ionizing radiation and flexibility is used, and, as for thickness, the thing of the range of about 200-12 micrometers is preferably used from points, such as a light weight, slimming down, etc. of the ease of carrying out of processing of detailed embossed geometry, and the liquid crystal display element used. As construction material of the sheet base material 4, polyester, such as polyethylene terephthalate and polyethylenenaphthalate, Polymethylmethacrylate, polymethyl acrylate, poly ethyl methacrylate, Methacrylic acid, such as polyethylacrylate, or the polymer (what is called an acrylic resin) of acrylic ester, polycarbonate, cellulose triacetate, polystyrene, polypropylene, etc. are raised. To the sheet base material 4, it is preferred to perform easily-adhesive processing of corona discharge treatment etc. to the surface if needed.

[0018]Although the pressing roll 5 just presses the sheet base material 4, it is usually a size about 140 mm in diameter, and can form the construction material by silicone rubber, NBR, EPT, etc. It can be freely rotated by the pressing roll 5 and the delivery roll 6 in order to send the sheet base material 4. Although form which is taken with the roll intaglio 1 and around which it turns may be sufficient as these, they can also be driven with a drive. A take-up motion which rolls round a sheet in which a sheet feeder and detailed embossing which send out the sheet base material 4 were formed can also be formed.

[0019]The hardening device 7a is equipment which irradiates with ionizing radiation and stiffens the ionizing-radiation-hardening-resin liquid 3. In order to stiffen thoroughly the disconnected ionizing-radiation-hardening-resin liquid 3a, the hardening device 7b may be formed. Here, ionizing radiation means what has an energy quantum which polymerizes and can construct a bridge in a molecule among electromagnetic waves or a charged particle beam, and ultraviolet rays, an electron beam, etc. are usually used. In the case of ultraviolet rays, as the hardening device 7, light sources, such as an ultrahigh pressure mercury lamp, a high-pressure mercury-vapor lamp, a low pressure mercury lamp, a carbon arc, a black light lamp, and a metal halide lamp, can be used.

[0020]In the case of an electron beam, a cockloft WARUTON type, a BANDE graph type, Equipment provided with an irradiation source of various electron beam accelerators, such as a resonance transformer type, an insulation core transformer type or a linear model, the Dynamitron type, and a high frequency type, etc. can be used, and it irradiates with an electron which has the energy of 100 - 300keV preferably 100 to 1000 keV. As an exposure dose, about 0.5-30 Mrad is usually preferred.

[0021]The coating apparatus 10 is equipment for coating the ionizing-radiation-hardening-resin liquid

3 to the roll intaglio 1, and it is desirable to use a nozzle coating apparatus (method shown in drawing 2). As for this nozzle coating apparatus, the nozzle of a prescribed dimension has T-die-like a rectangle or a linear delivery, The longitudinal direction of the delivery is installed in the direction (cross direction) which intersects perpendicularly with a roll intaglio hand of cut, it was provided so that width predetermined [of the overall widths of the roll intaglio 1] might be covered, and it has the discharging device for pressurizing the ionizing-radiation-hardening-resin liquid 3, and carrying out the regurgitation to curtain form to up to the roll intaglio 1. A nozzle coating apparatus is good to form the cavity 12 in the middle of a nozzle, in order to ease the nonuniformity of discharge quantity, and aging. As the coating apparatus 10, the coating apparatus by suitable means, such as the roll coat method and the knife coat method, may be adopted as the sheet base material 4 besides the above.

[0022]Although the graphic display has not been carried out, it passes through the ionizing-radiation-hardening-resin liquid 3 on the roll intaglio 1, there is nothing then, and after coating on the sheet base material 4, the film surface on the sheet base material 4 can also be pressed to the roll intaglio 1 with the pressing roll 5. It is more desirable to coat the resin liquid 3 to the roll intaglio 1 side, in order for there to be no mixing of air bubbles and to reproduce fine irregularities faithfully.

[0023]The solvent dryer 11 is equipment for volatilizing the solvent of resin. Warm air, an infrared heater, etc. can be used as the solvent dryer 11. Since solvent type resin can be used by forming this solvent dryer 11, the width of selection of the resin to be used spreads and harmony of coating nature also becomes easy. The dryer 11 is unnecessary when using the solventless type ionizing-radiation-hardening-resin liquid 3.

[0024]Next, the manufacturing method of the optical diffusion sheet of this embodiment is explained with operation of the manufacturing installation shown in drawing 2. First, it is made to contact so that the resin 3 which filled up the crevice 2 of the roll intaglio 1 with the ionizing-radiation-hardening-resin liquid 3 with the coating apparatus 10 (101 [like a packer]), and made the roll intaglio 1 fill it up with the sheet base material 4 may also be touched (contact process 102).

[0025]Here as a method of filling up the crevice 2 of the roll intaglio 1 with the ionizing-radiation-hardening-resin liquid 3, As shown in drawing 2, when the specified quantity coating of the ionizing-radiation-hardening-resin liquid 3 is beforehand carried out to the surface of the roll intaglio 1 and the base material sheet 4 is supplied to it to the roll intaglio 1, Distribution restoration of the ionizing-radiation-hardening-resin liquid 3 coated via the base material sheet 4 by the press from the base material back side of the pressing roll 5 is carried out into the crevice 2. In this case, the ionizing-radiation-hardening-resin liquid 3 which could use solvent type hardening resin and was coated by the sheet base material 4, In order to control mobility to some extent, dry removal of the solvent etc. which were used in order to dilute the solvent of the resin liquid 3 is carried out with the dryer 11, and semi-hardening of the resin liquid 3 which dried the solvent is further carried out with the hardening device 7a. As shown in drawing 2 (A), the number of the hardening devices 7a may be one, but they provide hardening device 7a-1 [two or more (this embodiment five pieces)] - 7a-5, and it may be made to make a multistage story harden the resin liquid 3 in the roll intaglio 1, as shown in drawing 2 (B). If it does in this way, even if it makes quick strike speed of the sheet base material 4, it is desirable by obtaining sufficient dose and making it harden gradually in order to reduce distortion of the hardened material of the resin liquid 3, and curl of the sheet base material 4 and distortion.

[0026]Subsequently, while the sheet base material 4 is in contact with the roll intaglio 1 (stage which sends with the pressing roll 5 in a figure and when it is specifically located between the rolls 6), the ionizing-radiation-hardening-resin liquid 3 is stiffened with the hardening device 7a (curing process 103).

[0027]In this embodiment, when irradiating with ionizing radiation with the hardening device 7a, are carried out from the sheet base material 4 side, but. The permeability of ionizing radiation, such as quartz and glass, can form the roll intaglio 1 according to good construction material, and it can also glare from the inside side of the roll intaglio 1 (irradiation equipment specifically installed in roll hollow). It may glare from both sides the sheet base material and inside side of an intaglio.

[0028]With the hardening device 7, the ionizing-radiation-hardening-resin liquid 3a in the crevice 2 of the roll intaglio 1 is stuck to the sheet base material 4 (adhesion process 104). At this time, the hardening degree should just be a grade which makes the mobility of the resin 3 lose at least, and produces adhesion with the sheet base material 4.

[0029]After passing the hardening device 7, the sheet base material 4 is exfoliated from the roll intaglio 1 (peeling process 105). The hardened ionizing-radiation-hardening-resin liquid 3a is united with the sheet base material 4 by this, it disconnects itself of the crevice 2, and the optical diffusion

sheet 9 which has an irregular surface is obtained.

[0030]Next, the optical diffusion sheet manufactured by the method by this embodiment and the liquid crystal display using it are explained. Black and white or a color (natural color is included) may be sufficient as the thing of various systems with a publicly known liquid crystal display in an object. The number and character which are used for displays, such as a clock, an electronic calculator, various meters, and a word processor, may be displayed, and the general pictures the object for Television Sub-Division, for the output monitors of an electronic computer, etc. may be displayed.

[0031]Drawing 3 is a figure showing the embodiment of a liquid crystal display which used the transmission type optical diffusion sheet. In itself, it places and illuminates the light source 32 at the rear face in order to raise the visibility of the display in a dark place, since the liquid crystal display 31 does not emit light. As the light source 32, although a fluorescent lamp, a filament lamp, etc. can be used, a white fluorescent lamp is usually preferably used from points, such as a whiteness degree, low calorific power, and a life. It is accommodated in the light reflex frame 33, and is reflected with the light reflector 34 by the side of a rear face, and the light source 32 lets the light curtain 35 pass, and illuminates the liquid crystal display 31. At this time, the form of the light source 32 is not conspicuous, and the optical diffusion sheet 36 which diffuses the transmitted light from the light source 32 is needed so that a screen may serve as a uniform luminosity. The optical diffusion sheet 36 is a sheet which diffuses the transmitted light, and as shown in drawing 3 (B), the detailed embossing layer 36b which becomes the sheet base material 36a from the hardened material of ionizing radiation hardening resin is formed.

[0032]Drawing 4 is a figure showing the embodiment of a liquid crystal display which used the reflection type optical diffusion sheet. The transparent light guide plate 42 made from an acrylic is arranged, and the cold cathode floor line lamp 44 accommodated in the lamp holder 43 on the side of this light guide plate 42 is formed in the rear face of the liquid crystal display 41. The optical diffusion sheet 45 is arranged in the rear face of the light guide plate 42. As this optical diffusion sheet 45 is a sheet which diffuses a reflected light and it is shown in drawing 4 (B), The light reflection layer 45b by metal membranes, such as aluminum, chromium, and silver, is formed in the rear face of the sheet base material 45a, and the detailed embossing layer 45c which consists of a hardened material of ionizing radiation hardening resin is formed in the surface. The substrate 45d may be laminated if needed. As for this, the same may be said of a transmission type case.

[0033]The figure, drawing 10, and drawing 11 in which the example of whether the optical diffusion sheet manufactured by the manufacturing method which requires drawing 5 – drawing 9 for an embodiment goes was shown typically are a figure for explaining the optical property of an optical diffusion sheet. The important point is as follows although an optical diffusion sheet is diffuse transmission or a thing which carries out diffuse reflection about the beam of light from a light source (line light source or point light source).

[0034]** First, by an optical diffusion sheet blooming cloudy (printing), like glass, if light is completely diffused isotropic, light will be distributed also to the tangent method of a practically unnecessary optical diffusion sheet, and the utilization efficiency of light will become low. For this reason, it is made only for the inside of the angle range which an observer observes to diffuse light practically. Specifically as this angle range, half angle θ_H is raised. The angle range which the transmissivity (or reflectance) of the normal line direction N of a display screen decreases half angle θ_H with the increase in the angle from the normal N, and the light intensity I decreases to 1/2 of the transmissivity (or reflectance) of the normal line direction N is said (drawing 10).

[0035]Although half angle θ_H is based also on a use, generally a horizontal direction and the perpendicular direction of about $10^\circ \leq \theta_H \leq 60^\circ$ are preferred. It is about $40^\circ \leq \theta_H \leq 60^\circ$ more preferably. However, in order for the use of a monitor of Television Sub-Division, a word processor, an electronic computer, etc., etc. to mainly require a horizontal view, When horizontal half angle θ_{HH} and perpendicular direction half angle θ_{HV} are respectively made into $40^\circ \leq \theta_{HH} \leq 60^\circ$ and about $10^\circ \leq \theta_{HV} \leq 20^\circ$, the utilization efficiency of light energy is good, and a screen is also legible (drawing 11).

[0036]** Next, the transmissivity (or reflectance) of light and its angular dependence do not need to have change by the place of an optical diffusion sheet, and need to be uniform.

[0037]** Although form is designed fill ** of a more than, and **, the example shown in drawing 5 – drawing 9 as desirable form is given. Before long, drawing 5 – drawing 8 are the so-called eye lens of a fly, or its modification. The optical diffusion sheet 50 shown in drawing 5 arranges many semi-spherical optical elements 51. The optical diffusion sheet 60 shown in drawing 6 arranges many optical elements 61 with the side dented toward the outside of a cone form. Pitch Pmin = it is about 100 micrometers. The optical diffusion sheet 70 shown in drawing 7 arranges many optical elements

71 of a cone form. 120 theta= 90 degrees of vertical angles, 110 degrees, or degrees are processible. [0038]The optical diffusion sheet 80 shown in drawing 8 arranges many optical elements 81 of the shape of prism, such as two equilateral triangles. Here, 120 theta= 90 degrees of vertical angles, 110 degrees, or degrees are processible. Pitch Pmin = it is about 70 micrometers. If the about 5–10–micrometer flat portion 82 is formed between each optical element 81 as shown in drawing 8 (B), process tolerance will improve more.

[0039]The optical diffusion sheet 90 shown in drawing 9 arranges many optical elements 91 which carried out a Fresnel lens or form of the modification. The heights form of the optical element 91 may be not a concentric circular ring group but a convex same mind polygon (3, 4, 5, 6, 7, octagon, etc.)–like group (not shown), as shown in a figure.

[0040]In addition, as an eye lens of a fly, or its modification, what arranged much identical shape of a polygonal pyramid, a truncated cone, or a polygonal–pyramid stand and form of the same object kind isotropic on a flat surface can be formed, for example. As a pyramid or a truncated pyramid, if right 6–sided the Shozo pyramid (or frustum), a right pyramid (or frustum), and pyramids (or frustum) are used, here, It can arrange that there is no crevice in a flat surface, and form is also isotropic, a level and also perpendicularly equivalent half angle can be given, there is also no change by a place, and it is desirable.

[0041]A detailed embossing layer may be formed in any of the surface of the sheet base material 4, and a rear face, and can also be provided in rear surface both sides. What provided a light diffusion layer which consists of the detailed right hexagon–head pyramid–like lens element 61 like drawing 6 in the surface (the liquid crystal side) as an example which provides a light diffusion layer in both sides, for example, and provided a light diffusion layer of concentric circle shape in a rear face like drawing 9 is raised.

[0042]As a processing method of these form, on the roll of ** metal etc., use an engine lathe, and process it, or ** numerical control, for example with the cutting machine carried out. After processing a metaled prototype, carry out hardening processing of the prototype itself, or. Or when the sectional shape of the normal line direction of the method of processing uneven shape into a metallic roll–like plate by the publicly known mill processing method from a prototype using as a mill what molded uneven shape further to another metal with electroforming, and the ** version is simple, the publicly known optical corroding method can also be used.

[0043]

[Effect of the Invention]As explained in detail above, resin liquid is coated on a sheet base material, and since resin is fabricated in the form of the roll intaglio designed beforehand, the detailed embossed geometry of desired form is faithfully reproducible according to this invention. Therefore, a thing with a desired diffusing characteristic can manufacture with high degree of accuracy, and also it is hard to produce the variation by the place in a screen.

[0044]Since light diffusibility detailed embossed geometry is formed in the surface of transparent resin and an inside is not made to distribute foreign matter particles, an optical diffusion sheet with few losses of light is obtained.

[0045]Since detailed embossing is formed by a rotary shaping system using a roll intaglio and the shaping is also stiffened instantly by ionizing radiation, carrying out the strike of band–like Webb's sheet base material, it can mass–produce.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is process drawing showing the embodiment of the manufacturing method of the optical diffusion sheet by this invention.

[Drawing 2]It is a figure showing the embodiment of the manufacturing installation of the optical diffusion sheet by this invention.

[Drawing 3]It is a figure showing the embodiment of the liquid crystal display using a transmission type optical diffusion sheet.

[Drawing 4]It is a figure showing the embodiment of the liquid crystal display using a reflection type optical diffusion sheet.

[Drawing 5]It is a figure showing typically the example of the optical diffusion sheet manufactured by the manufacturing method concerning an embodiment.

[Drawing 6]It is a figure showing typically the example of the optical diffusion sheet manufactured by the manufacturing method concerning an embodiment.

[Drawing 7]It is a figure showing typically the example of the optical diffusion sheet manufactured by the manufacturing method concerning an embodiment.

[Drawing 8]It is a figure showing typically the example of the optical diffusion sheet manufactured by the manufacturing method concerning an embodiment.

[Drawing 9]It is a figure showing typically the example of the optical diffusion sheet manufactured by the manufacturing method concerning an embodiment.

[Drawing 10]It is a figure for explaining the optical property of an optical diffusion sheet.

[Drawing 11]It is a figure for explaining the optical property of an optical diffusion sheet.

[Drawing 12]It is a figure showing other examples of the roll intaglio used for the manufacturing installation of the optical diffusion sheet concerning an embodiment.

[Explanations of letters or numerals]

1 Roll intaglio

3 Ionizing-radiation-hardening-resin liquid

4 Sheet base material

5 Pressing roll

6 Delivery roll

7 Hardening device

10 Coating apparatus

50 - 90 optical diffusion sheet

101 Like a packer

102 Contact process

103 Curing process

104 Adhesion process

105 Peeling process

[Translation done.]

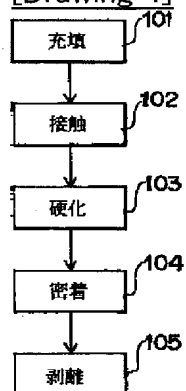
* NOTICES *

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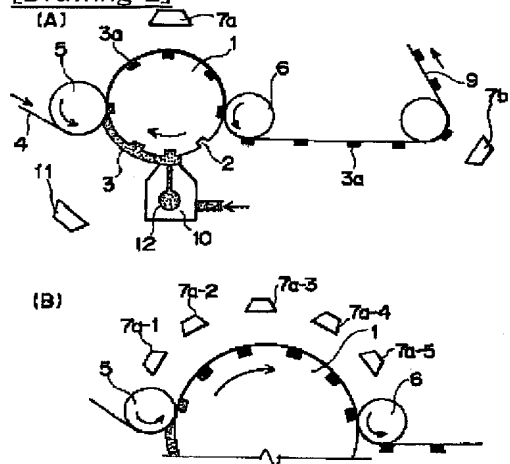
- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.*** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DRAWINGS

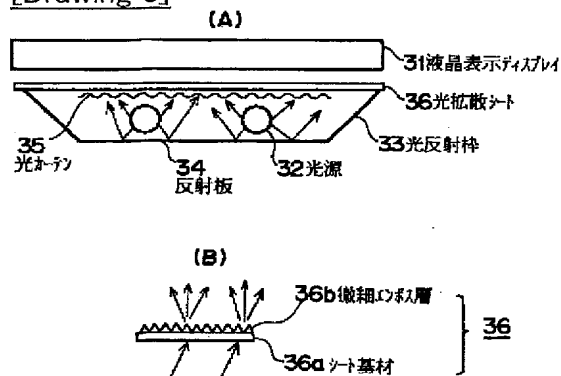
[Drawing 1]



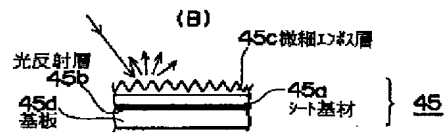
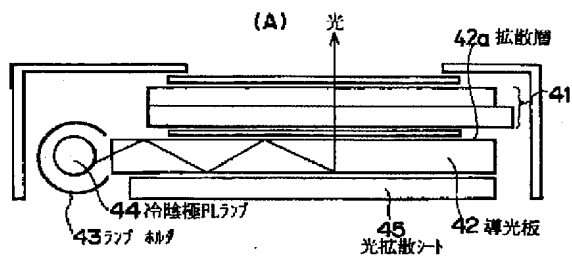
[Drawing 2]



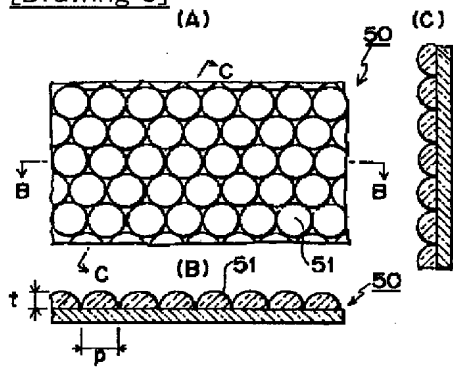
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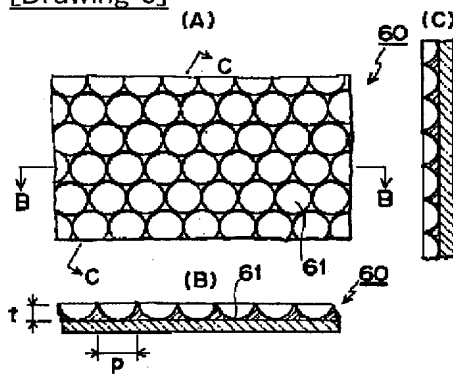
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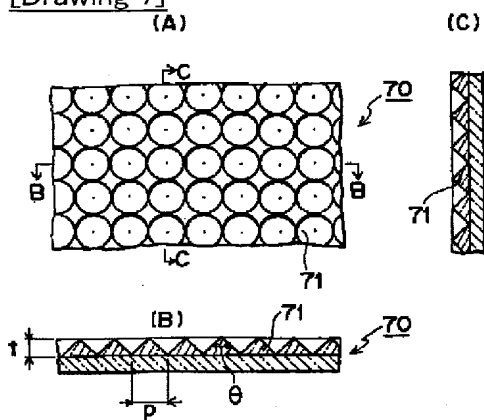
[Drawing 5]



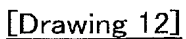
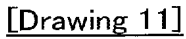
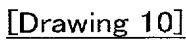
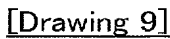
[Drawing 6]

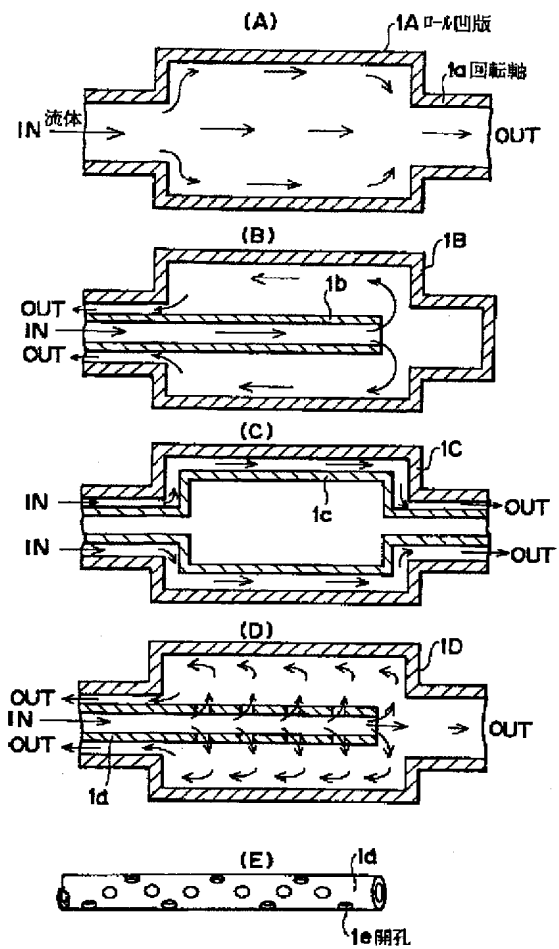


[Drawing 7]



[Drawing 8]





[Translation done.]